REMARKS

In this Amendment C accompanying Request for Continued Examination, Applicants respond to the Office action of June 27, 2005.

Status of Claims:

Claims 1-7, 12-15, 21 and 62 are pending in the application. Claims 1-4 and 12-15 are allowed. Claims 5-7, 21 and 62 were rejected.

Rejections

I. In Response to Rejection under 35 U.S.C. 102(b):

Examiner has rejected claims 5- 9 and 21 as being anticipated by Alexander et al. However, inventions disclosed in claims 5- 9 and 21 are different from, and unobvious over, Alexander et al. in their configurations and functions, as more fully explained below. *Ex parte Masham*, 2 USPQ 2d 1647 (Patent Office Board of Appeals, 1987) is not applicable for reasons, *inter alia*, set forth below.

Regarding claim 5, it is noted that in referring to the limitation "invalid charge discharging unit" Examiner refers to only part of Applicants' claim 5, which includes the full limitation "an invalid charge discharging unit which drives said charge transfer unit to discharge an invalid charge while said charge accumulating units accumulate said signal charges." In doing so, Examiner refers to Alexander et al. at column 5, line 56-63 [actually that should for completeness of understanding be lines 52-63], which state:

> Bucket overload protection is assured by the creation of an overflow well 36 beneath the drain diffusion 22 of the detector 12 by the application of a positive (+30 volts) bias to the diffusion 22 and a lesser positive (+5 volts) bias to the bucket overload gate 28. As illustrated in FIG. 4a "excess" charge (the result of bloom at high illumination levels) adjacent the detector node 20 is dumped into the potential well 36 and removed from the drain diffusion 22 of the detector 12 by an overload bus (not shown). The charge integration time of the detector 12 may be varied, if desired, and some signal charge dumped by clocking the bucket overload gates. *[Emphasis ours.]*

Examiner contends that the "invalid charge discharging unit" (as referred to by Examiner) in the present invention is disclosed in Alexander et al. but that simply is not true, because the configurations of the invalid charge discharging unit in the present invention and

corresponding portions in Alexander et al. are different from each other. Where is the corresponding structural features in Alexander et al. that Examiner contends anticipate the apparatus set forth in claim 5? Examiner refers to Alexander et al. at col. 2, lines 8-15, but that section of Alexander summarizes only the reading of the collected charge characters. The referenced patent there says "Charge advanced to the output diffusion results in a single output from one of a number of output amplifiers which are multiplexed onto a common bus. The outputs of a number of such buses present a number of lines of readout which may be arrayed to present the two-dimensional image of near-IR illumination detected by the imager." That disclosure by Alexander et al. has nothing to do with Applicants' claimed feature of "*an invalid charge discharging unit which drives said charge transfer unit to discharge an invalid charge while said charge accumulating units accumulate said signal charges.*" [Emphasis ours.] Examiner should note that the latter features relates to discharging of invalid charges while said charge accumulating units accumulate said signal charges." The invalid charge discharging unit sweeps invalid charges out of the charge transfer unit while the charge accumulating units accumulate signal charges. This eliminates a possibility of residence of dark current arising on the first-plane side of the charge transfer unit, so the image sensor has lessened occurrence of dark current, and this is further emphasized in the next page.

Examiner next refers to Alexander et al. at col. 5, lines 52-63, as disclosing removal of excess charges [i.e., from bloom at high illumination levels] but Examiner should more carefully note the description there in Alexander et al., which is:

> Bucket overload protection is assured by the creation of an overflow well 36 beneath the drain diffusion 22 of the detector 12 by the application of a positive (+30 volts) bias to the diffusion 22 and a lesser positive (+5 volts) bias to the bucket overload gate 28. As illustrated in FIG. 4a "excess" charge (the result of bloom at high illumination levels) adjacent the detector node 20 is dumped into the potential well 36 and removed from the drain diffusion 22 of the detector 12 by an overload bus (not shown). The charge integration time of the detector 12 may be varied, if desired, and some signal charge dumped by clocking the bucket overload gates. [Emphasis ours.]

What Examiner may have failed to notice is the statement (see above) by Alexander et al. of ". . . removed from the drain diffusion 22 of the detector 12 by an overload bus (not shown)."

In other words, there is ***no disclosure*** by Alexander et al. of anything corresponding to Applicants' claimed feature of "an invalid charge discharging unit which drives said charge transfer unit to discharge an invalid charge while said charge accumulating units accumulate said signal charges."

That is another way of saying that there is not in Alexander et al. disclosure of a device or circuit corresponding to what Applicants have set forth in claim 5.

Therefore, an inescapable impression is that Examiner is attempting to equate "structures" as between Alexander et al. and Applicants invention of claim 5, which the Examiner has not identified. Stated otherwise, Examiner is attempting to read into Alexander et al. structure that is not present. It is respectfully contended that such is impermissible.

To be complete in discussing the matter, we should point out that the Alexander et al. patent discloses a "bucket overload gate 28." Examiner should appreciate, however, that the Alexander et al. gate 28 is used to apply a bias voltage for spillover potential, so that substantially no charge carriers will be read out of said apparatus at said output diffusion until addressed by a transfer gate located in the readout layer.

In spite of the structural differences as between Applicants' claim 5 and Alexander et al., Examiner attempts to reply upon the decision *Ex parte Masham*, 2 USPQ 2d 1647 (Patent Office Board of Appeals, 1987) to supply the missing structure. *[Incidentally, to correct the record, which may go up on appeal, the case citation "2 USPQ F.2d 1647" in the Office action is not correct. It confuses because "F.2d" refers to the second series of the West Federal Reporter, a case law reporter which is not "USPQ" meaning United States Patent Quarterly.]* It is hoped that Examiner will again read the actual *Ex parte Masham* decision to better appreciate why it does not apply to the present situation. *Ex parte Masham* is not properly applicable to the present case because Applicants' claims recite different elements which are specified with different features and for different purposes.

Applicants wish to explain more fully, for Examiner should appreciate that Applicants' invention provides in the paragraph at page 6, lines 28 ff., that

> In the configuration described above, the invalid charge discharging unit sweeps invalid charges out of the charge transfer unit while the charge accumulating units accumulate signal

charges. This eliminates a possibility of residence of dark current arising on the first-plane side of the charge transfer unit, thereby realizing an image sensor with less occurrence of dark current.

Examiner has referred to Alexander et al. col. 5, lines 56-63, which state:

> As illustrated in FIG. 4a "excess" charge (the result of bloom at high illumination levels) adjacent the detector node 20 is dumped into the potential well 36 and removed from the drain diffusion 22 of the detector 12 by an overload bus (not shown). The charge integration time of the detector 12 may be varied, if desired, and some signal charge dumped by clocking the bucket overload gates.

Examiner may wish to read the next several lines of Alexander et al. which state:

> During the charge integration period, the detector unit is not addressed by the readout circuitry. Zero (or a negative) bias applied to the transfer gate 30 during this period assures that the flow of collected charge will be directed solely to the overflow potential well 36, eliminating the possibility of undesired charge overflow (and subsequent premature readout) at the readout well 38 beneath the positively-biased output diffusion 24.

The "invalid charge discharging unit" in claim 5, as more specifically set forth there, drives the charge transfer unit to discharge an invalid charge while the charge accumulating units accumulate the signal charges. Examiner can get a better understanding by referring to Applicants' specification at p. 29, lines 26-30, which sets forth these features in this way:

> When a charge accumulating time is extended in order to detect weak light, the dark current accumulated into the CCD diffusion layers 13 become not negligible. For this reason, the vertical transfer unit 16, during the charge accumulating period, successively applies a transfer voltage to the transfer electrodes 15 to discharge invalid charges out of the CCD diffusion layers 13, so that the dark current are suppressed as much as possible. *[Emphasis added.]*

There is no corresponding structure in Alexander et al. that anticipates, shows or teaches the disclose by Applicants of such vertical transfer unit 16, which during the charge accumulating period, successively applies a transfer voltage to the transfer electrodes 15 [see

Applicants' Figure 2, for example) to discharge invalid charges out of the CCD diffusion layers 13.

Other structural significant differences and function in Alexander et al. could be here emphasized. As will be discussed below relating to Applicants' claim 6, Examiner should carefully understand that Alexander et al. have specifically described something distinctly different from Applicants' image sensor. At col. 4, lines 43-53, the patent of Alexander et al., it describes that:

> Beneath each of the above mentioned epitaxial layer 18 diffusions, there is situated a heavily doped (p-type) slab 26 at the interface of the epitaxial layer 18 and the intrinsic substrate 14. The slab 26 is grounded and acts as a plane to shield the electric fields occasioned by the above-mentioned biases from the charge carriers (electrons in the illustrated embodiment) generated in the substrate 14. Its presence assures that the electron charge carriers migrate only toward the collection node 20 (under the influence of the bias of storage gate 21) rather than the (biased) diffusions 22, 24.

That is neither the structure nor the operation nor purpose of elements in Applicants' image sensor. And so to emphasize, this is yet another structural difference of Alexander et al. as compared to Applicants' image sensor, which is yet another reason that *Ex parte Masham* is not properly applied.

The devices of Alexander et al. and of Applicants are <u>not structurally interchangeable</u> for these reasons, among others. They are not the same structures used for handling a different "material intended to be worked upon" as was found in comparing mixing machines as in *Ex parte Masham.* Examiner may not yet have appreciated that Alexander et al. have taught a construction useful only for detection of "near infrared (IR)" (0.8 to 1.0 μm) which means that the device has been constructed to allow the long infrared wavelengths (which penetrate deeply into the device) to result in electron-hole pair generation at levels in the device useful for causing the electron charge characters to migrate to the collection node, and such also requires substantial and careful biasing, as explained in Alexander et al. The system disclosed by Alexander et al. simply could not be used without redesign as Applicants have intended that is as an image sensor for energy rays including visible light, ultraviolet rays, soft X-rays, and electron beams.

For example, the Alexander et al. patent notes that the performance and development of similar devices at near-IR is hampered by the relatively deep photon penetration incurred at near-IR. So also, that patent discusses the relatively dimensionally enormous differences between such a near-IR device and a CCD device technology (as in the present patent application), noting "It has been established that about ten percent of incident 0.9 μm photons remain unabsorbed at a depth of 35 μm in silicon. Yet, the depletion region of a present-day commercial CCD fabricated on an extrinsic substrate is typically 2 μm or 3 μm deep." (Alexander et al. col. 1, lines 25-30.) Examiner really must appreciate that such involves an order of magnitude (ten times) in dimensional difference. (The expression "dimensionally enormous" is entirely relative, for the chip array shown in Figure 1 of Alexander et al. is said to be only 0.2 x 0.2 inch.)

It should now be apparent to Examiner that one device (Alexander et al.) cannot be substituted for the other (Applicants').

Examiner has failed to show that Alexander et al. provides structure which is the equivalent of that of image detector of claim 5. What is there in Alexander et al. to correspond to the claimed feature of "an invalid charge discharging unit which drives said charge transfer unit to discharge an invalid charge while said charge accumulating units accumulate said signal charges"? There is no disclosure of the corresponding apparatus which, as explained above, is a vertical transfer unit 16 (which is not part of the semiconductor structure per se, but is shown in Applicants' Figure 1; and there is no such corresponding structure shown in Alexander et al. but instead only the readout structure and circuitry of that patent's Figure 5); and it is such vertical transfer unit 16 that, during the charge accumulating period, successively applies a transfer voltage to the transfer electrodes 15 to discharge invalid charges out of the CCD diffusion layers 13. As we have pointed out above, the Alexander et al. patent has a different structure (and different purpose for same). See, for example, the heavily doped p-layer slab 26, namely "The slab 26 is grounded and acts as a plane to shield the electric fields occasioned by the above-mentioned biases from the charge carriers (electrons in the illustrated embodiment) generated in the substrate 14." (Alexander et al.; col. 4, lines 46-50. *[Emphasis added.]*)

To consider whether *Ex parte Masham* could even be considered, Examiner would have to demonstrate that the structures of the device of the claim(s) and those of the reference are the same, and only their recited uses are different. That is not true of the present comparison.

In *Ex parte Masham*, the Board was concerned very simply with a preamble recitation "for mixing flowing developer material . . ." and the additional recitation in the body of the claim "completely submerged in the developer material" which the Board said related to the identity of the material worked upon by the claimed apparatus and the intended manner of employing the claimed apparatus. The Board said:

> [A] recitation with respect to the material intended to be worked upon by a claimed apparatus does not impose any structural limitations upon the claimed apparatus which differentiates it from a prior art apparatus satisfying the structural limitations of that claimed. See In re Rishoi, 197 F.2d 342, 94 USPQ 71 (CCPA 1952) and In re Young, 75 F.2d 996, 25 USPQ 69 (CCPA 1935). Similarly, a recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus satisfying the structural limitations of that claimed. *[Emphasis added.]*
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> 2 USPQ2d at 1648.

Examiner has not demonstrated that the monolithic imager for near-IR described by Alexander et al. satisfies the structural limitations of Applicants' claim 5.

Accordingly, this is not an occasion appropriate for the simplistic application of *Ex parte Masham*, because this is not a situation where the prior art apparatus teaches all the structural limitations of the claim. This is not a situation where the only difference is a claim containing a "recitation with respect to the manner in which a claimed apparatus is intended to be employed." Applicants' image array invention is thus to be contrasted with the simple mechanical structure of *Ex parte Masham*, where the Board noted that the preamble of claim 1 recited that the apparatus was "for mixing flowing developer material" and the body of the claim recited "means for mixing ..., said mixing means being stationary and completely submerged in the developer material". The claim in *Ex parte Masham* was rejected over a reference which taught all the structural limitations of the claim for the intended use of mixing flowing developer. However, the mixer was only partially submerged in the developer material. The Board held that the

amount of submersion is immaterial to the structure of the mixer and thus the claim was properly rejected. Such a case has no present relevance to an electronic device (and its circuitry) designed for a specific purpose, function and operation.

The application of *Ex parte Masham* to an electronic combination as here claimed amounts at least to a serious lack of understanding or perhaps a denial of the complexity of design, fabrication and operation of semiconductor devices, especially those of photonic/optoelectronic species, as are here presently involved and claimed. The subject matter of the present application, as intrinsic and characteristic of the genre of photonic or optoelectronic devices of microscopic character here implied, is complex. Such devices require a deep and intimate knowledge of electronic and semiconductor design theory and circuit theory, theoretical investigations of low-dimensional semiconductor heterostructures or microstructures, as well as semiconductor and doped semiconductor physics and behavior, and beyond that, such devices involve extraordinary design time, complex and expensive semiconductor design fabrication, testing and evaluation require and, in general, are the result of an enormous investment in person-hours, fabrication and testing facilities, and detailed evaluation. That is no less true of the image sensor here involved and claimed.

Examiner should well appreciate that such devices and constructions as the present invention far transcend the simple mechanics of the devices involved in *Ex parte Masham*. The presently claimed devices do not lend themselves to a simple analysis. That is also true of devices of the character set forth in Alexander et al. It is here most respectfully contended that Examiner engages in unwarranted and impermissible reconstruction of the Alexander et al. patent in contending, in simplistic terms, that (as according to *Ex parte Masham*) there has been only a mere recitation with respect to the material intended to be worked upon by a claimed apparatus that "does not impose any structural limitations upon the claimed apparatus which differentiates it" from a prior art apparatus satisfying the structural limitations of that claimed. Not only is it true that the disclosure of Alexander et al. does not satisfy the structural limitations of the present claim, but also the very notion that there has been here only a "mere recitation with respect to the material intended to be worked upon" is wrong.

If such a naïve notion were permitted to be applied by the Patent and Trademark Office to a complex device of the present invention, it would entirely vitiate and treat as trivial the enormous effort of the most sophisticated engineers in the present highly advanced and complex technology. Image sensors, specifically that here claimed, cannot be compared to the simple mechanical mixer for material upon which the *Ex parte Masham* decision was predicated. It is both scientifically misguided and legally dangerous, indeed erroneous in the extreme, to attempt to extrapolate from the Board ruling in that simple case to reach the strained result of the present Office action.

Moreover, it ought to be pointed out that the present claim 5 is not a "means plus function" claim as found in *Ex parte Masham* but instead the recital "invalid charge discharging unit which drives said charge transfer unit to discharge an invalid charge while said charge accumulating units accumulate said signal charges" is scientifically meaningful and definitive only when considered in its entirety. It is not amenable to being parsed into some simple noun or "means" followed by a function. Rather, it has to be considered as a whole to have a precise meaning scientifically in a way which is instructive to the skilled artisan. It does not amount to a mere operational restriction as was involved in the simple structure considered by the Board in *Ex parte Masham*. At the risk of repetition, it must be said that this limitation finds no equivalent correspondence in Alexander et al.

It might as well be noted for the record, as it may be considered on appeal, that the decision of the Board of Patent Appeals and Interferences in *Ex parte Masham,* although referred to in the Manual of Patent Examining Procedure (MPEP), has been little recognized or has been bypassed elsewhere. Only the case decision of *Research Corp. et al. v. Gensia Laboratories et al.*, 10 Fed. Appx. 856; 2001 U.S. App. LEXIS 4444 (Fed. Cir. 2001) is found in Shepardizing the *Masham* decision as having cited *Masham* (among other decisions). In *Research Corporation*, the court (in reviewing the case below it *de novo*, as it does in patent cases), had before it a double patenting issue regarding a composition claim that contains a material that in fact protects it from light, and said the court, the only apparent distinction between the claimed composition protected from light and that not protected from light is how it is treated, which the

court found was not a structural or otherwise meaningful claim limitation. It does not seem to the undersigned that *Masham* was central to the decision in *Research Corporation*.

In any event, it is believed the attempted application of *Ex parte Masham* to the claim in the present application is all the more inappropriate.

In summary regarding claim 5, the devices of claim 5 and Alexander et al. are substantially different, they function differently and they involve different theories of design. They are not equivalent. The decision of *Ex parte Masham* is not applicable to the claim. Applicants request accordingly that the rejection of claim 5 be withdrawn and the claim allowed as patentably unobvious over the art.

Specifically regarding claim 6, Examiner states in the action that Alexander et al. discloses in col. 5, line 65- col. 6, line 3 the dark current suppressing unit in claim 6 of the present invention. However, configuration disclosed in col. 5, line 65- col. 6, line 3 of Alexander et al. cannot suppress the dark current flowing in from the first-plane side, as in the present invention. The limitation "a dark current suppressing unit which approximates a potential of the first-plane side of said charge transfer unit to a substrate potential to suppress dark current flowing in from said first-plane side, at least during a predetermined period while said charge accumulating units accumulate said signal charges" is scientifically meaningful and definitive only when considered in its entirety. It is not amenable to being parsed into some simple noun or "means" followed by a function. Rather, it has to be considered as a whole to have a precise meaning scientifically in a way which is instructive to the skilled artisan. It does not amount to a mere operational restriction as was involved in the simple structure considered by the Board in *Ex parte Masham*.

Besides, there is an important functional difference which Examiner may not have appreciated. The dark current suppressing unit in the present claim 6 approximates a potential of the first-plane side of the charge transfer unit to a substrate potential to suppress dark current flowing in from the first-plane side to the charge transfer unit, as is written out in the claim. In contrast, the potential control by the transfer gate 30, which is the part in Alexander et al. corresponding to the dark current suppressing unit, cannot suppress this dark current like the

present invention. Alexander et al. does apply zero bias to the transfer gate 30 to create a wall of potentials so that the possibility of charge overflow from node 20 to output diffusion 24 can be eliminated. Also, while Alexander et al. does have what corresponds to the dark current from the first-plane side of the present invention, which is the dark current which generates between the epitaxial layer 18 and the layer 29, it must be clearly emphasized that the potential control by the transfer gate 30 is only a partial potential control and cannot suppress, as can be understood from Figure 4a of Alexander et al.

At risk of repetition, Applicants submit that Examiner needs to understand exactly that Alexander et al. have specifically described something distinctly different from Applicants' image sensor. Specifically considering col. 4, lines 43-53 of Alexander et al., it is described that:

> Beneath each of the above mentioned epitaxial layer 18 diffusions, there is situated a heavily doped (p-type) slab 26 at the interface of the epitaxial layer 18 and the intrinsic substrate 14. The slab 26 is grounded and acts as a plane to shield the electric fields occasioned by the above-mentioned biases from the charge carriers (electrons in the illustrated embodiment) generated in the substrate 14. Its presence assures that the electron charge carriers migrate only toward the collection node 20 (under the influence of the bias of storage gate 21) rather than the (biased) diffusions 22, 24.
> *[Emphasis added.]*

That is neither the structure nor the operation nor purpose of elements in Applicants' image sensor, such as elements 17 and 17a (as in Applicants' Figure 2, 13 and 14, 17b and 24, for example).

Beginning with the first line of p. 30 of Applicants' specification, Applicants explain what takes place, leading to the advantage of suppressing dark currents, as follows:

> Moreover, at pixels from which the invalid charges are discharged, the vertical transfer unit 16 fixes the transfer electrodes 15 to a negative voltage in succession and approximates the surface potentials of the CCD diffusion layers 13 to the substrate potential. Due to the operations, holes gather near the surfaces of the CCD diffusion layers 13 to prevent the CCD diffusion layers 13 from surface depletion. Consequently, as shown in Fig. 8, dark current that go into the CCD diffusion layers 13 can be greatly suppressed during the period of negative voltage application.
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> Due to both of or either of the effects, dark current can be suppressed to a negligible level even in the cases of accumulating weak light for a long time.

That is, Examiner may well come to appreciate that when a charge accumulating time is extended in order to detect weak light, the dark current accumulated into the CCD diffusion layers 13 of Applicant's device become not negligible. For this reason, the vertical transfer unit 16, during the charge accumulating period, successively applies a transfer voltage to the transfer electrodes 15 to discharge invalid charges out of the CCD diffusion layers 13, so that the dark current are suppressed as much as possible.

In contrast, in Alexander et al., according to col. 5, lines 62- 63 (that Examiner pointed out), it is explained that the Alexander et al. device discharges signal charges of the well 34 (defined by node 20) to the bucket overload gate (gate 28 and diffusion 22). There is only disclosed discharging signal charges instead of invalid charges, and the bucket overload gate is not a charge transfer unit. This discharging operation in Alexander et al. does not discharge the invalid charges generated at the transfer unit (output diffusion 24).

In summary, the devices of claim 6 and Alexander et al. are substantially different, function differently and involve different theories of design. They are not equivalent. The decision of *Ex parte Masham* is not applicable to the claim.

Concerning claim 7, Examiner states in the action that Alexander et al. discloses in col. 5, line 65- col. 6, line 3 the excessive charge discharging unit in claim 7 of the present invention. However, Examiner has ignored that all of the so-called "structural" limitations have not been met by Alexander et al. and so *Ex parte Masham* is not relevant. The configuration of the invalid charge discharging unit in the present invention and the configuration disclosed in col. 5, line 65- col. 6, line 3 in Alexander et al. are different from each other.

The excessive charge discharging unit in the present claim 7 drives the charge transfer unit to discharge the excessive charge occurring due to exceeding of a saturation charge amount of the charge accumulating units, as is written out in the claim. Examiner states that the function of discharging the excessive charge overflowed from the well 34 (node 20) to the bucket overload gate (gate 28 and diffusion 22) in Alexander et al. corresponds to the function of the excessive charge discharging unit in the present claim 7. However, the bucket overload gate is

not the same as the charge transfer unit of the present invention. Moreover, what does correspond to the charge transfer unit in Alexander et al., which is the output diffusion 24, is not driven to discharge excessive charge by the function disclosed in Alexander et al. in col. 5, line 65- col. 6, line 3.

Examiner refers to a portion of the claim language reciting "excessive charge discharging unit" but fails to consider properly the more precise and complete limitation of "an excessive charge discharging unit which overflows an excessive charge into said charge transfer unit in a vertical direction, from the charge accumulating units on the second-plane side to the charge transfer unit on the first-plane side and drives said charge transfer unit to discharge said excessive charge, said excessive charge occurring due to exceeding a saturation charge amount of said charge accumulating units." But the claim language is scientifically meaningful and definitive only when considered in its entirety. It is not amenable to being parsed into some simple noun or "means" followed by a function. Rather, it has to be considered as a whole to have a precise meaning scientifically in a way which is instructive to the skilled artisan. It does not amount to a mere operational restriction as was involved in the simple structure considered by the Board in *Ex parte Masham.*

There are important differences between the image detectors of Applicants and Alexander et al. It is necessary for Examiner to understand them. Applicants' claimed image detector is also different from Alexander et al. in that Applicants' device provides an operational mode advantage in the event of illumination of the backside with strong light. This is explained in two paragraphs on page 30 (beginning on line 9) of Applicants' specification in this way:

> On the other hand, when illuminated with strong light, the potential wells in the charge accumulating units 17 are saturated to let excessive charges flow out. The conventional back-illuminated image sensor was provided with lateral overflow drains in order to prevent excessive charges from overflowing the potential wells of the CCD diffusion layers to cause a phenomenon of blurring the sensed image (so-called blooming). For that reason, the image sensor conventionally had to degrade its opening ratio corresponding to the sizes of the lateral overflow drains. *[Emphasis ours.]*
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> Nevertheless, the image sensor 11 of the present invention, as shown in Fig. 9, adjusts the voltages applied to the transfer electrodes 15, so that excessive charges out of

> the charge accumulating units 17 overflow into the CCD diffusion layers 13. The excessive charges are discharged to exterior along with the dark current described above. Therefore, the blooming phenomenon can be improved without degrading the opening ratio of the image sensor. *[Emphasis added.]*

But to re-emphasize, the bucket overload gate of Alexander et al. is not the same as the charge transfer unit of the present invention. Moreover, the charge transfer unit in Alexander et al., which is the output diffusion 24, as pointed out above, is not driven to discharge excessive charge by the function disclosed in Alexander et al. in col. 5, line 65- col. 6, line 3.

In summary, the devices of claim 7 and Alexander et al. are substantially different, function differently and involve different theories of design. They are not equivalent. The decision of *Ex parte Masham* is not applicable to the claim.

Concerning claim 21, it should be noted that claim 21 was previously amended so that it is dependent on claim 5. Therefore, because claim 5 is free of reasons to reject, claim 21 should also be. It is submitted to be allowable with claim 5. Again, for the reasons set forth above, *Ex parte Masham* is believed not to be applicable to the claim.

Concerning claim 62, it should be noted that this claim is dependent from claim 5. Therefore, because claim 5 is free of reasons to reject, claim 21 should also be. It is submitted to be allowable with claim 5. Again, for the reasons set forth above, *Ex parte Masham* is believed not to be applicable to the claim.

II. Summary

Accordingly, claims 1-7, 12-15, 21 and claim 62 are believed to be neither anticipated nor rendered obvious by the art of record.

The rejections based on Alexander et al. and *Ex parte Masham*, 2 USPQ 2d 1647 (Patent Office Board of Appeals, 1987) should be properly withdrawn.

It is believed that the foregoing resolves all remaining issues, and the application is in good order for allowance, and a Notice of Allowance is solicited. If Examiner believes there is any remaining issue, which

could be readily resolved or other action could be taken to advance this application, such as Examiner's amendment or interview by telephone or in person, it is requested that Examiner please telephone the undersigned, who will cooperate to advance prosecution, and who will if necessary be prepared to interview in the application.

If necessary to effect a timely response, this paper and accompanying documents including Request for Continued Examination should be considered as a petition for extension of time of length sufficient to be considered timely. Any fees required are authorized to be charged to Deposit Account No. 07-1985.

Respectfully submitted,

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Date

Peter S. Gilster, Reg. No. 25,337
Attorney for Applicants
Greensfelder, Hemker & Gale, PC
10 S. Broadway, Suite 2000
St. Louis, Missouri 63102
314-345-4741 Telephone Office Direct
314-241-9090 Telephone Office General
314-345-4704 Facsimile
Customer No. 22807

PSG:kmb

Appendix Showing Specification Changes :

Paragraph beginning on page 2, line 30 (and bridging to page 3)

In addition, the conventional image sensor 601 has had a problem that many dark currents arise at the interface between the antireflection film 609 and the semiconductor base 602, and at the interface between the gate oxide film 604 and the CCD diffusion layer 603. Such dark currents have caused unwanted effects including a deterioration in imaging quality and the impossibility of weak light detection.